

**AMENDMENTS TO THE SPECIFICATION**

At page 3, line 20 to page 4 line 8, please replace the specification with the following:

Among the liquid anti-microbial agents which are suitable in certain applications, a preferred anti-microbial agent is dibromocyanoacetamide (for example, Amerstat AMERSTAT<sup>®</sup> 300 made by Drew Industrial Division of Ashland Chemicals, Boonton, N.J. 07005).

In addition, solid anti-microbial agents that are preferred include 2-bromo-2-nitropropane-1,3-diol (for example, Canguard CANGUARD<sup>®</sup> 409 made by Angus Chemical Co., Buffalo Grove, Ill. 60089) and 3,5-dimethyltetrahydro-1,3,5-2H-thiazine-2-thione (for example, Nuosept NUOSEPT<sup>®</sup> S made by Creanova, Inc., Piscataway, N.J. 08855 or Troysan TROYSAN<sup>®</sup> 142 made by Troy Chemical Corp., West Hanover, N.J. 07936).

Other solid anti-microbial agents include N- (trichloromethyl)-thiophthalimide (for example, Fungitrol FUNGITROL<sup>®</sup> 11 made by Creanova, Inc.), butyl-p-hydroxy-benzoate (for example, Butyl Parabens BUTYL PARABENS<sup>®</sup> made by International Sourcing Inc., Upper Saddle River, N.J. 07458), diiodomethyl-p-tolysulfone (for example, Amical AMICAL<sup>®</sup> WP made by Angus Chemical Co.), and tetrachloroisophthalonitrile (for example, Nuocide NUOCIDE<sup>®</sup> 960 made by Creanova, Inc.).

Starting at page 4, line 25 to page 5 line 6, please replace the specification with the following paragraph:

Silver containing zirconium phosphate (for example, AlphaSan ALPHASAN<sup>®</sup> RC 5000 containing 3.8% silver provided by Milliken Chemical, Spartanburg, SC 29304)

is also particularly useful. In general zirconium phosphates act as ion exchangers. However, ~~AlphaSan~~ ALPHASAN® RC 5000 is a synthetic inorganic polymer that has equally spaced cavities containing silver, wherein the silver provides the anti-microbial effects. Silver zirconium phosphates are typically incorporated into powder coatings between 0.1 and 10 percent by weight and particularly 0.5 to 5 percent by weight of the total powder coating

Starting at page 13, line 21 to page 13, line 24, please replace the specification with the following paragraph:

Six anti-microbial agents were selected for experimentation. They are ~~Fungitrol~~ FUNGITROL® 11, ~~Amerstat~~ AMERSTAT® 300, ~~Nuocide~~ NUOCIDE® 960, ~~Nuosept~~ NUOSEPT® S, ~~Propyl Parabens~~ PROPYL PARABENS®, and ~~Butyl Parabens~~ BUTYL PARABENS®. For each powder coating formulation, one of the six anti-microbial agents was added at concentrations of 0.1 percent and 1 percent of the total resin weight.

Starting at page 15, line 8 to page 15, line 11, please replace the specification with the following paragraph:

The ~~Amerstat~~ AMERSTAT® 300 showed significantly improved bacterial coverage compared to the other additives and the control. The effect of decreasing the additive concentration was minimal. Decreasing the coating thickness had very little effect on the anti-microbial activity of the coating.

Starting at page 15, line 12 to page 16 line 9, please replace the specification with the following paragraph:

Among the tested additives, ~~Propyl Parabens~~ PROPYL PARABENS® and ~~Nuosept~~ NUOSEPT® S did not appear to improve the activity relative to the control and

thus it was concluded that little or no effect on the long-term anti-microbial properties given the chosen resin matrix.

The same samples were also exposed to fungus spores for a period of four weeks. Results of the study showed that several of the coatings showed no growth of fungi on their surface after four weeks of exposure. At a concentration of 1 percent, powder coatings made with the ~~Butyl BUTYL and Propyl Parabens PROPYL PARABENS~~, and ~~Nuocide NUOCIDE~~ 960 were free of visible fungal growth. ~~Fungitrol FUNGITROL~~ 11 and ~~Amerstat AMERSTAT~~ 300 had a very small amount of fungal growth. The ~~Nuosept NUOSEPT~~ S did not show conclusive fungal resistance.

An additional study was then undertaken using AATCC Test Method 30-1993, Part III. In this test, a control, ~~Fungitrol FUNGITROL~~ 11, ~~Amerstat AMERSTAT~~ 300, ~~Nuocide NUOCIDE~~ 960, ~~Nuosept NUOSEPT~~ S, ~~Propyl Parabens PROPYL PARABENS~~ and ~~Butyl Parabens BUTYL PARABENS~~ formulations were applied to steel coupons, as described previously. The samples were placed in sterile Petri dishes with Seboraud Dextrose Agar, inoculated with *Aspergillus niger*, (AATCC 6275), and incubated at 28°C for three weeks. The fungus was placed on top of the coating as well as on the agar.

Starting at page 16, line 21 to page 17 line 2, please replace the specification with the following paragraph:

Steel coupons were coated with the ~~Fungitrol FUNGITROL~~ 11, ~~Butyl Parabens BUTYL PARABENS~~, and ~~Amerstat AMERSTAT~~ 300 anti-microbial formulations, at 0.1 percent and 1 percent, and exposed as per ASTM D 5588-94 to a mixture containing the bacteria *Pseudomonas aeruginosa*, *Staphylococcus aureus*, and *Escherichia coli*. After the coupons were washed with a 70 percent ethanol/water

solution, they were placed in a sterile Petri dish, inoculated, and incubated at 32°C for the duration of the test.

Starting at page 17, line 13 to page 17, line 17, please replace the specification with the following paragraph:

Heavy bacterial growth was detected initially and after 4 hours for all samples; however, after 24 hours of exposure, differentiation in growth was visible among the samples. After 72 hours of incubation, the ~~Butyl Parabens~~ BUTYL PARABENS®-coated samples were free of bacterial growth and were actually sterile. The control showed low to heavy growth. The ~~Amerstat~~ AMERSTAT® 300 and ~~Fungitrol~~ FUNGITROL® 11 did not show conclusive results.

Starting at page 18, line 4 to page 18, line 7, please replace the specification with the following paragraph:

Heavy fungal growth was detected initially and after 4 hours for all samples. However, once again, at 24 hours of exposure, differentiation among the samples was observed. After 72 hours of incubation, ~~Fungitrol~~ FUNGITROL® 11- and ~~Butyl Parabens~~ BUTYL PARABENS®-coated samples were free of (or showed very low levels of) bacterial growth.

Starting at page 18, line 9 to page 18 line 15, please replace the specification with the following paragraph:

Using AATCC Test Method 147 (Nutrient Broth, incubated at 37°C for 18 to 24 hours), another test of very short term efficacy was undertaken. Cured powder coating formulations containing (0.1 percent and 1 percent) ~~Fungitrol~~ FUNGITROL® 11, ~~Amerstat~~ AMERSTAT® 300, ~~Nuocide~~ NUOCIDE® 960, ~~Nuosept~~ NUOSEPT® S, ~~Propyl Parabens~~ PROPYL PARABENS®, and ~~Butyl Parabens~~ BUTYL PARABENS® were

exposed to a concentration of (inoculated) *Staphylococcus aureus*, *Escherichia coli*, and *Salmonella choleraesuis* for an exposure period of 18 to 24 hours. None of the formulations were effective in significantly killing the microorganisms over the short test cycle.

Starting at page 18, line 17 to page 18, line 22, please replace the specification with the following paragraph:

The next experiments were conducted, according to the procedure of Example 3, to evaluate the effect of higher anti-microbial concentration on short-term anti-microbial activity. Coating powers containing 2 percent ~~Amerstat~~ AMERSTAT® 300, 4 percent ~~Treysan~~ TROYSAN® 174P, 5 percent ~~Canguard~~ CANGUARD® 409, 3 percent ~~Irgasan~~ IRGASAN® DP 400, 5 percent ~~Amical~~ AMICAL® WP, 5 percent ~~Nuosept~~ NUOSEPT® S, 10 percent ~~Nuosept~~ NUOSEPT® S, 5 percent ~~Nuocide~~ NUOCIDE® PCMC, and 10 percent ~~Nuocide~~ NUOCIDE® PCMC were used in the next experiment.

Starting at page 19, line 1 to page 19, line 11, please replace the specification with the following paragraphs:

Significant zones of inhibition were achieved by the powder coatings containing 5 percent ~~Canguard~~ CANGUARD® 409, (bronopol), 3 percent ~~Irgasan~~ IRGASAN® DP 400 (triclosan, 5-chloro-2-(2,4 dichloro-phenoxy) phenol and 5 percent and 20 percent ~~Nuosept~~ NUOSEPT® S. The bronopol (2-bromo-2-nitropropane-1,3-diol) formulation performed better than the triclosan formulation in inhibiting the growth of *Escherichia coli* and *Salmonella choleraesuis*.

The ~~Nuosept~~ NUOSEPT® S performed as well as or better than the triclosan formulation in inhibiting the growth of *Escherichia coli* and *Salmonella Choleraesuis*.

Thus, one preferred anti-microbial composition includes a mixture of anti-microbial agents that have short-term efficacy with agents having long-term efficacy. One preferred mixture includes 5 percent ~~Nuosept~~ NUOSEPT® S and 0.1 percent Amerstat AMERSTAT® 300 in a powder coating formulation.

Starting at page 28, line 14 to page 28, line 23, please replace the specification with the following paragraph:

Three different powder coating formulations were prepared by combining and blending silver zirconium phosphate with the above listed components of the urethane based powder coating. For example, referring to Table 5, formulation 2 contained 1% by weight based on the sum of the other powder coating components, and formulation 3 contained 2% by weight of the silver zirconium phosphate. Formulation 1, a control formulation, did not contain silver zirconium phosphate; therefore, silver was not present in this powder coating composition. In contrast, formulations 2 and 3 contained 0.038% and 0.076% respectively, silver in the powder coating composition (the concentration of silver in ~~AlphaSan~~ RC ALPHASAN® RC 5000 (3.8%) multiplied by the % weight of ~~AlphaSan~~ ALPHASAN® added to the particular formulation), as shown in Table 5.

Starting at page 30, line 3 to page 30, line 12, please replace the specification with the following paragraph:

The results of these experiments indicate that silver zirconium phosphate is an effective anti-microbial agent when combined with urethane based powder coating components at the premix phase. As expected, formulation 1, which did not contain silver zirconium phosphate, did not exhibit bactericidal activity. In other words, formulation 1 did not inhibit bacterial growth. However, formulations 2 and 3 both exhibited bactericidal activity at a 99.99% Kill Efficiency. That is, formulations 2 and 3

containing 1% and 2% respectively of the ~~AlphaSan RC~~ ALPHASAN® RC 5000 killed 99.99% of the bacterial growth. Thus, silver, in the form of silver zirconium phosphate is an effective anti-microbial agent when incorporated into urethane powder coatings at the premix stage.